

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C.**

In the Matter of

Interference Immunity Performance
Specifications for Radio Receivers

ET Docket No. 03-65

REPLY COMMENTS OF MICROSOFT CORPORATION

It seems fair to say that most commenters in this proceeding, whether for or against Commission regulation of receiver performance, focused their initial comments almost exclusively on a small number of legacy bands. CMRS licensees and handset manufacturers wrote mainly about CMRS (largely opposing any regulation of receiver performance); broadcasters wrote about broadcast spectrum (largely supporting such regulation); commenters from the public safety community wrote mainly about public safety (largely supporting regulation of receiver performance standards, though some of these commenters appear to want public safety receivers to be exempted). Microsoft perceives the issues raised in this Inquiry to be much more far-reaching.

The issue of whether the Commission should explicitly specify levels of interference immunity for receivers is an issue much larger than any one band, and it deserves to be treated as such. Microsoft is generally in favor of interference immunity specifications, especially to the extent that they are performance-based (such as the interference temperature metric) rather than design-based. Microsoft's own comments, like the Commission's NOI, recognized that legacy bands are the most difficult to deal with, and recommended that the Commission start with new

bands. Interestingly, if one puts aside the problem of legacy bands, the record contains very little of substance in opposition to Commission regulation of interference immunity. Microsoft continues to believe that in general, as a matter of fundamental orientation in the Commission's spectrum policy, the degree of interference protection conferred by FCC authorization should be quantified, and an "interference immunity" specification of some kind (of which interference temperature is the most obvious example) is in the public interest.

In these Reply Comments, Microsoft will maintain its focus on the more general question, without debating the merits of imposing receiver standards in particular bands. Picking up the strands of general argument that were mixed with the particular oppositions that were filed, these Reply Comments seek to demonstrate the following: (1) the interference temperature metric is indeed available today for incorporation into the Commission's rules; (2) if interference immunity is specified in "performance-based" terms like interference temperature, it will not adversely affect freedom to innovate; (3) specification of interference immunity is not *inherently* onerous to incumbents, nor are non-onerous specifications *ipso facto* irrelevant or ineffectual; and (4) specifying interference immunity will increase rather than decrease spectrum efficiency.

I. THE INTERFERENCE TEMPERATURE METRIC IS AVAILABLE TODAY.

Some commenters suggested that this Inquiry is premature. Specifically, BellSouth and Cingular argued in their joint comments that the Commission's inquiry into receiver performance is either procedurally premature (until the Commission responds to the comments on the Spectrum Policy Task Force Report)¹ or technically impossible (until the Commission has completed studies on the noise floor in various bands).² BellSouth and Cingular ask the

¹ BellSouth and Cingular Comments at 9.

² BellSouth and Cingular Comments at 9-10.

Commission to suspend the Inquiry altogether, and claim that the very issuance of the NOI “demonstrates that the Commission is in the midst of a rush to judgment regarding the interference temperature concept.”³

A notice of inquiry – that is, a collection of questions unaccompanied by any concrete proposal, not even a tentative one – is generally not perceived as a “rush to judgment.” The criticism made by these commenters probably reflects their concern about the possibility for “underlay” use of CMRS spectrum. Without discussing the CMRS bands in particular, Microsoft does agree that underlay allocations and interference immunity specifications are closely related, but they are nonetheless distinct and deserve to be considered separately.

Microsoft disagrees with the assertion that interference temperature is “undefined and scientifically unfounded.”⁴ On the contrary, the *Spectrum Policy Task Force Report* cited previously published definitions of the concept. Nor does the specification of an interference temperature below which a receiver must operate without harmful interference require any study of the actual noise floor in a given band. On the contrary, it would not be at all difficult for a broadcast television engineer to express the implicit receiver requirements of sections 73.612, 73.613, and 73.683 of the Commission’s rules in terms of an interference temperature in degrees Kelvin, in the presence of which a television receiver must be expected to operate normally.⁵

³ BellSouth and Cingular Comments at 8.

⁴ BellSouth and Cingular Comments at 9.

⁵ As previously stated, Microsoft is not here suggesting any particular interference temperature standard in any particular band. However, solely for purposes of illustration, consider broadcast television channel 3 (60 - 66 MHz) with adjacent channels 2 (54 - 60 MHz) and 4 (66 - 72 MHz). Section 73.612 states, “The nature and extent of the protection from interference accorded to TV broadcast stations is limited solely to the protection which results from the minimum allotment and station separation requirements and the rules and regulations with respect to maximum powers and antenna heights set forth in this subpart.” Section 73.613(g) states, “A TV broadcast station application will not be accepted if the ratio in dB of its field strength to that of the Class A TV station at the Class A TV station's protected contour fails to meet the following: . . . (2) 6 dB when the protected Class A TV station operates on a VHF channel that is one channel above the requested channel. (3) 12 dB when the protected Class A TV station operates on a VHF channel that is one channel below the requested channel.” Section 73.683 requires
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This is an important point, because it demonstrates that to the extent we are considering new services in vacant bands, assigning an interference temperature to the receivers in the new service is not difficult, requires no empirical surveys, and may very well be implicit in other technical rules being proposed for the new service. It is for this reason that Microsoft urged the Commission to implement the concept without delay in new allocations and assignments. Moreover, the television example in the notes goes even further, demonstrating that derivation of an interference temperature may be a simple mathematical exercise even in some legacy bands.

Thus, developing an interference temperature metric to be used for setting receiver performance standards is clearly feasible today. The hard part is developing an interference temperature metric that will maximize the underlay capacity while simultaneously minimizing interference to licensed services. That task requires the Commission to specify not only the interference levels that a receiver must accept, but also the emission levels that an underlay device can transmit. The *SPTF Report* suggested that the transmit limitations could even be a function of the environment, raising questions relative to sensing the environment. In any band in which the Commission authorizes underlay devices, there will be a non-zero possibility of interference. Deciding the acceptable probability of interference is going to make for a very

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the field strength to be 68 dBuV/m for Grade A contours. Combining 73.613 with 73.683 we find that the maximum allowable field strength of a channel 2 transmitter at the channel 3 contour is 74 dBuV/m (68 dBuV/m + 6 dB), and for a channel 4 transmitter it is 80 dBuV/m (68 dBuV/m + 12 dB). So, one form of a partial TV receiver performance spec is: “The TV receiver shall operate normally when tuned to channel 3 in the presence of a first interfering signal of 74 dBuV/m in the band 54 - 60 MHz, and of a second interfering signal of 80 dBuV/m in the band 66 - 72 MHz.” A second form of the partial spec: “The TV receiver shall operate normally when tuned to channel 3 in the presence of a first interfering signal of 89 dB(K/m²) in the band 54 - 60 MHz, and of a second interfering signal of 95 dB(K/m²) in the band 66 - 72 MHz.” Translating these various formulations into the framework recommended in Microsoft’s original comments, a partial immunity specification based on interference temperature would read, “A television receiver operating on channel 3 shall not be entitled to protection from a transmitter operating in the same band or different bands, in the same service or a different service, unless said receiver is capable of operating normally when in the presence of an interference temperature environment, as measured at the output of an isotropic antenna, specified by 1.5 billion degrees K in the band 54 – 60 MHz and 6

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contentious proceeding, as the BellSouth and Cingular Comments foreshadow. But the Commission's current Inquiry is not the vehicle for settling upon a precise number in any band, let alone any CMRS band.

Thus it appears that the charge of prematurity leveled by BellSouth and Cingular puts matters exactly backwards. Interference immunity specifications are the *first* step in making "white space" available for underlay services to use, not a step that must be postponed until some later date. And interference temperature is a convenient and already-available metric for expressing such standards, regardless of whether the standards ultimately prove conducive to underlays or not.

II. "PERFORMANCE-BASED" SPECIFICATION OF INTERFERENCE IMMUNITY WILL LEAVE MANUFACTURERS AND SERVICE PROVIDERS FREE – AND MOTIVATED – TO INNOVATE.

Many commenters expressed concern that if the Commission were to require receivers to achieve certain levels of interference immunity, there might be a negative effect on the freedom to innovate. The Commission's NOI discussed the same question, as did Microsoft's comments. Unfortunately, most of the commenters raising this question failed to consider what has been called a "performance-based" standard.⁶

Performance-based standards, according to CTIA, "define a desired outcome rather than mandate the method or design that must be implemented."⁷ Microsoft aimed at the same point when noting that the interference temperature metric would "specify[] a *what* but not a *how*."⁸

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billion degrees K in the band 66 – 72 MHz."

⁶ CTIA Comments at 4-5. CTIA notes that the distinction between "performance standards" and "design standards" has statutory pedigree, appearing in the Regulatory Flexibility Act. CTIA Comments at 5 n.11.

⁷ CTIA Comments at 4.

⁸ Microsoft Comments at 11.

The Wi-Fi Alliance captured the same basic idea by distinguishing between “receiver performance” on the one hand and “interference immunity” on the other. Although the terminology may have differed, the point was clear enough in the comments of any party that wished to acknowledge the distinction. Nearly all commentators expressed the view that the Commission should not micromanage hardware design by promulgating inflexible standards governing specific design parameters. However, when it comes to performance-based specifications, there is absolutely nothing in the record to indicate how these more general rules might threaten innovation.⁹

Nor is there any reason to believe specification of interference immunity might reduce the *incentive* for innovation. A wide range of commenters who opposed any Commission-imposed specification of interference immunity went out of their ways to detail all the improvements their respective industries had made voluntarily over the years, and several of these commenters implied that Commission specifications would somehow disrupt the voluntary processes. The Consumer Electronics Association argued, “FCC-adopted standards would weaken or remove marketplace incentives because of the delay that would be caused by requiring navigation of the regulatory hurdles of notice-and-comment rulemaking to implement changes.”¹⁰ But again, this criticism seems to be aimed at a design-based standard rather than a performance-based standard. A performance-based standard would set a minimum while allowing for *better* performance; no notice-and-comment rulemaking would be required in order to permit such an improvement. Furthermore, if it is true that there are currently strong incentives for some manufacturers and service providers to make voluntary *and continuous*

⁹ While there may be exceptional cases in which such specificity is obviously in the public interest and is necessary to address some form of market failure, Microsoft agrees that such cases will be the exception to the general rule of leaving system design to the marketplace.

improvements on their own, then obviously these commenters believe the incentive to improve exists even when there is an existing industry standard that has fallen out of date. It is difficult to understand how the *incentive* to improve would be any weaker when the outdated standard is regulatory than when the outdated standard is the result of an industry negotiation.

It is certainly fair to note that specification of interference immunity, *if badly done*, might constrain innovation and be contrary to the public interest. In fact, Microsoft made this point. But it is a mistake to assume, as many commenters apparently did, that the Commission will do the job badly. The smarter alternative of using a performance-based specification exists, and no commenter has offered a persuasive reason why a performance-based specification would adversely affect innovation.

III. SPECIFICATION OF INTERFERENCE IMMUNITY CAN BE EFFECTIVE WITHOUT BEING UNDULY BURDENSOME.

Microsoft's comments drew attention to the "boundary" function that could be performed by specification of interference immunity for receivers: By denying protection from harmful interference below a certain interference temperature, the Commission would essentially be quantifying how intensively a licensee would be permitted to use the spectrum, and at the same time quantifying how much potential there might be for "leftover" spectrum use by an "underlay" service. A number of other commenters acknowledged the connection between interference immunity standards and underlay allocations, and some commenters – who apparently believe *underlays* would be unduly burdensome – argued that interference immunity specifications imposed as a precursor to underlays would (therefore?) be unduly burdensome. This argument does not withstand scrutiny.

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10 CEA Comments at 5.

Motorola, for example, puts the argument this way: “[T]he process of developing receiver performance specifications should not be used as an opportunity to impose overly burdensome standards on the industry in order to increase access by unproven ‘underlay’ users that are seeking to operate in licensed bands.”¹¹ The key words, of course, are “overly burdensome.” The Commission shouldn’t impose *overly* burdensome standards on anyone, for any reason. But there is no reason to suppose in advance that any interference immunity specification will be overly burdensome. As Microsoft explained in its Comments, allocation tables and service rules already presume a certain implicit level of interference immunity in many cases, and these rules would not become more burdensome simply by being made explicit. In short, if the boundary is overly burdensome to the licensed service, then it is a bad boundary. But neither the interference temperature concept, nor the underlay concept, nor any other spectrum management concept should be rejected on the ground that it would be bad if done badly.

Moreover, as Microsoft also explained in its initial Comments, important public interest benefits flow from setting a boundary in any given band, even if the boundary is *less* demanding for an incumbent than the then-current state of the art, and even if the boundary clearly leaves little or no room for “underlay” use. Clear definition of boundaries for spectrum rights facilitates voluntary transactions for spectrum access, making clear to an incumbent that future improvements in receiver performance can be harnessed either to improve the existing service or to create a “private commons.” The incumbent wins either way once the boundary is set; and in the same fashion, the public wins either way in the setting of the boundary. Thus, not only is there no built-in incentive for the Commission to settle on unduly burdensome specifications;

¹¹ Motorola Comments at 5.

there is in fact substantial incentive for the Commission to accept a boundary that is clearly not disruptive to the licensed service. Perhaps counter-intuitively, even an unduly generous boundary is better than no boundary at all.

IV. SPECIFICATION OF INTERFERENCE IMMUNITY WILL INCREASE RATHER THAN DECREASE SPECTRUM EFFICIENCY.

BellSouth and Cingular claim that specification of interference immunity standards below 3 GHz will lead to less efficient utilization of the spectrum.¹² Their reasoning seems to be that the spectrum below 3 GHz is already used much more intensively than the spectrum above 3 GHz, and therefore any regulatory measure that makes even greater use of the spectrum below 3 GHz is inefficient because it will lead to reduced demand for spectrum above 3 GHz.

The BellSouth/Cingular claim presents a false dichotomy. It is not unlike an argument that it would be inefficient for the United States to pursue economic growth because our economy is already larger than others. The obvious question is why we should not increase our spectrum efficiency in *all* bands, both above and below 3 GHz? We should, of course, and better receiver performance will permit us to do just that.¹³

CONCLUSION

The adoption of interference immunity specifications will not, by itself, impose onerous equipment burdens on incumbents, or create new interference problems between primary and underlay users. Nor will it decrease spectrum efficiency or limit in any degree the freedom and incentive to innovate that equipment makers and service providers currently enjoy. What it will

¹² BellSouth and Cingular Comments at 11-14.

¹³ Ericsson raises one additional argument against interference immunity specifications, claiming implausibly that such specifications will impede international trade by creating market-specific technical requirements. The same, of course, could be said about transmitter regulations, or even allocation tables – not to mention the technical standards that are sometimes enforced by regulators outside the United States.

do is begin to define more clearly the rights conferred by a Commission license. Without this step, it will be very difficult for the Commission to make any significant improvements in spectrum access, even in lightly used bands. With this step, the Commission will provide the certainty necessary for a “private commons” approach by incumbents as well as an underlay approach by the Commission, in bands where either may be appropriate. The Commission should move forward with the Inquiry and begin adopting interference immunity specifications in newly allocated bands as quickly as possible.

Respectfully submitted,

A handwritten signature in dark ink, appearing to read "Mark A. Grannis", written over a horizontal line.

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